DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES
PMB 2020
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February 11, 2011

Carl Daly
Acting Director, Air Program
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Dear Mr. Daly:

Thank you for EPA's December 16, 2010, response to the Department of Environment and Natural Resources' (DENR's) request for concurrence on using the Plume Volume Molar Ratio Method (PVMRM) option in the AERMOD modeling system. EPA agrees that PVMRM within the AERMOD modeling system may be used by DENR for the 1-hour nitrogen dioxide National Ambient Air Quality Standard modeling for the Hyperion project.

However, EPA requested DENR address EPA's comments and recommendations in the December 16, 2010, letter for EPA to give its concurrence on using the PVMRM option. EPA identified and commented on five areas: 1) ozone data, 2) nitrogen dioxide background concentration, 3) nitrogen dioxide to nitrogen oxide ratio, 4) stack parameters, and 5) generator operations.

Ozone Data

EPA recommends DENR address temporal variability by averaging seasonal or monthly monitored values for the modeling periods when hourly values from Sioux Falls were not available. In addition, EPA notes the selection of a seasonal or monthly monitored value representing the high end of the monitored ozone values as the substitute in the Sioux Falls data would be considered more conservative and appropriate for the analysis.

The ozone data from the Hilltop monitoring station in Sioux Falls, South Dakota for calendar years 2000 through 2006 is being used. This ozone data corresponds with the calendar years for the meteorological data sets used in the modeling. Ozone values for calendar years 2002 through 2004 at the Hilltop monitoring station were only collected during the ozone season (May through September). As recommended by EPA, all the hourly values monitored for each month for calendar years 2000, 2001, 2005, and 2006 were averaged. Then the highest monthly average of

the four years was used for the missing ozone data in the corresponding month. Table 1 lists the averages for each month of calendar years 2000, 2001, 2005, and 2006 and the highest monthly average used in the modeling.

Table 1 – Monthly Ozone Averages (parts per billion) [1]

Month	Year 2000	Year 2001	Year 2005	Year 2006	Value Chosen
January	0.016	0.025	0.021	0.020	0.025
February	0.018	0.034	0.023	0.028	0.034
March	0.021	0.036	0.034	0.033	0.036
April	0.029	0.034	0.037	0.039	0.039
May	0.037	0.035	0.035	0.039	0.039
June	0.029	0.043	0.043	0.043	0.043
July	0.035	0.039	0.039	0.040	0.040
August	0.035	0.036	0.032	0.033	0.036
September	0.033	0.034	0.035	0.025	0.035
October	0.022	0.028	0.024	0.025	0.028
November	0.022	0.023	0.020	0.018	0.023
December	0.023	0.021	0.017	0.017	0.023

[1] – The actual number used in the modeling may differ slightly due to rounding the numbers to three decimal points.

Nitrogen dioxide background concentration

One of the nitrogen dioxide emission sources in the area of the proposed Hyperion Energy Center comes from vehicle exhaust on the major roads of Interstate 29, Highway 48, and Highway 50. Air monitoring sites UC #1 and UC #2 were setup to test for background levels of nitrogen dioxide prior to construction of the proposed Hyperion facility. These sites were located so background air quality data would include emissions from vehicles. See Figure 1 for a map showing the area around the facility including locations of air monitoring sites and traffic counts for major roads

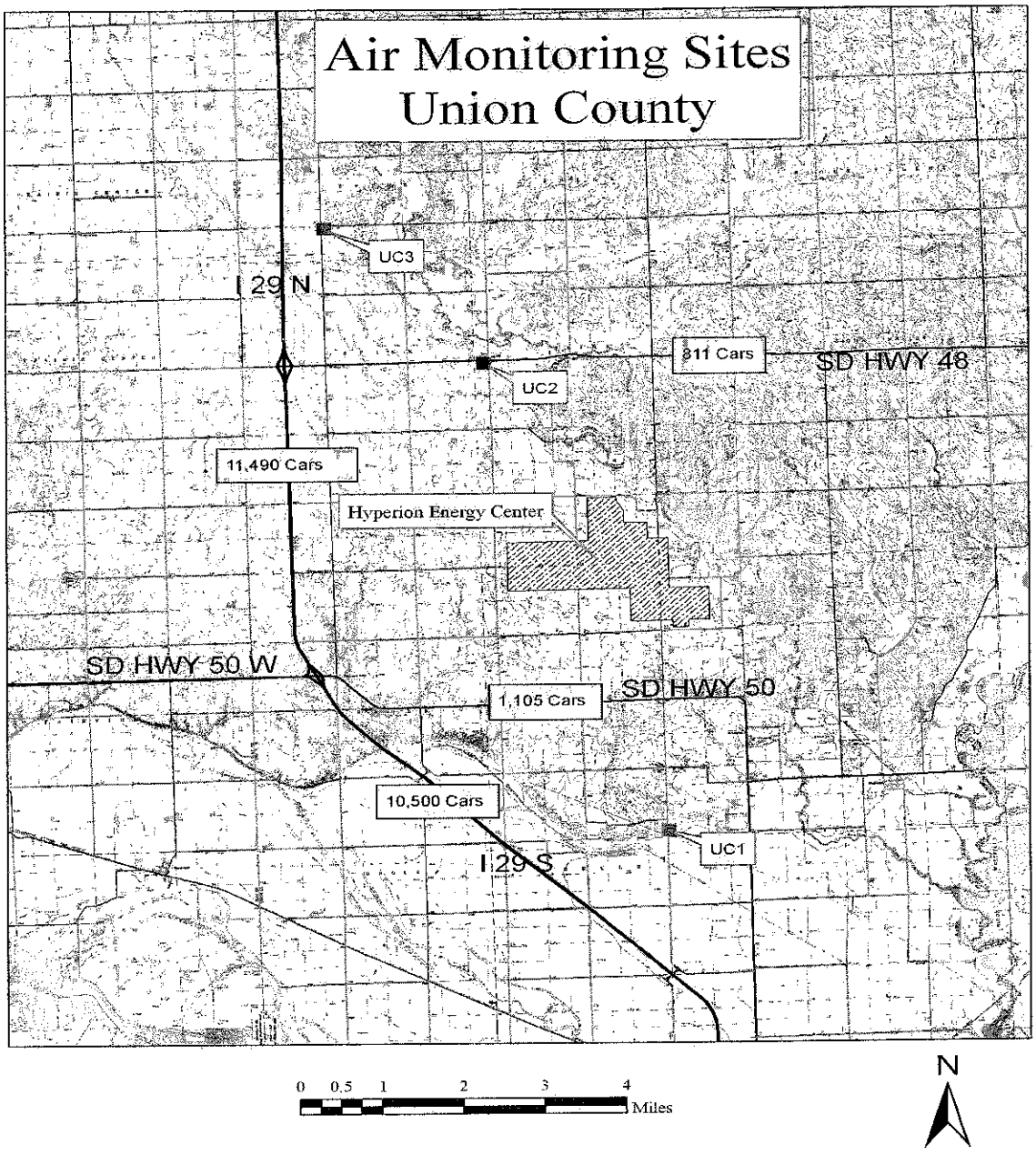
Interstate 29 has the highest daily average traffic counts. Traffic count data for 2009 received from the South Dakota Department of Transportation show a daily average of 10,500 vehicles traveling south of the interchange with Highway 50 and 11,400 vehicles traveling north of the interchange with Highway 50.

Highway 48 has a daily average traffic count of 811 vehicles. Highway 50 has a daily average traffic count of 1,105 vehicles. Vehicle emissions from Highway 48 and 50 will have little effect on nitrogen dioxide background levels at the proposed facility because traffic counts are low on these two highways.

UC #1 Site is located to the south southeast of the proposed facility. Interstate 29 runs generally north and south until the interchange with Highway 50. South of the interchange with Highway 50, Interstate 29 angles to the southeast towards North Sioux City. UC #1 Site at its closest point is located 1.52 miles northeast of Interstate 29 and 0.98 miles west of Highway 50. At this

location UC #1 Site will collect background data including the vehicle emissions when winds are out of the southwest, south, and southeast.

Figure 1 – Map of Background Air Monitoring Sites in Union County



UC #2 Site is located to the north northwest of the proposed facility. Interstate 29 north of the interchange with Highway 50 runs generally north and south. UC #2 Site is located 2.44 miles east of Interstate 29 and 170 feet south of Highway 48. At this location UC #2 will collect background data including the vehicle emissions when winds are out of the west, northwest, and north.

Nitrogen dioxide to nitrogen oxide ratio

EPA notes the 0.316 nitrogen dioxide to nitrogen oxide ratio is acceptable for use in the modeling. EPA does recommend the ratio be verified through post-construction in-stack testing/monitoring.

EPA's recommendation involves the type of requirements that may be included in Hyperion's permit. As such, DENR does not consider the recommendation as a requirement for EPA to concur the PVMRM option in the AERMOD may be used by DENR for the 1-hour nitrogen dioxide National Ambient Air Quality Standard modeling for the Hyperion project. DENR will consider EPA's comment as it reviews Hyperion's request, including potential changes to the permit.

Stack parameters

EPA notes several of the model inputs for the stationary source stack parameters to be out of range of values normally expected. EPA recommended a quality assurance review be conducted on these values before final modeling is conducted or provide a discussion and/or justification for the out of range values in a final report.

EPA notes stack temperatures for the Terra Nitrogen Port Neal facility and Hyperion's cooling tower cells appear to be too hot or too cold. For the Terra Nitrogen Port Neal facility, it appears EPA is referring to the 1,500 degrees Fahrenheit temperature for Unit #21. The modeling parameters for the Terra Nitrogen Port Neal facility were provided by the State of Iowa. As such DENR does not expect the data to be inappropriate. However, DENR obtained Terra Nitrogen Port Neal's Title V air quality permit for review. The Title V air quality permit lists the stack parameters for the emission units and on page 34 notes the stack temperature for Unit #21 is 1,500 degrees Fahrenheit.

For Hyperion's cooling tower cells, it appears EPA is referring to the negative 450 degrees Fahrenheit temperature. The cooling tower emissions would be released at ambient temperature conditions. As noted on page 3-18 of EPA's September 2004 "User's Guide for the AMS/EPA Regulatory Model – AERMOD" (EPA-454/B-03-001), it states if a value of 0.0 (Kelvin) is inputted for the exit temperature, AERMOD will adjust the exit temperature for each hour to match the ambient temperature. This option allows the user to model a plume that is released at ambient temperature. It should also be noted that Hyperion's current modeling is to demonstrate compliance with the new 1-hour sulfur dioxide National Ambient Air Quality Standard and the 1-hour nitrogen dioxide National Ambient Air Quality Standard. Hyperion's cooling cells do not emit sulfur dioxide or nitrogen dioxide. So modeling an emission rate of zero with any given temperature will not impact the results of the modeling.

EPA notes stack velocities are very high for the Terra Nitrogen Port Neal facility, Siouxland Ethanol, and Hyperion's Power Island Flare. For the Terra Nitrogen Port Neal facility, it appears EPA is referring to the 517 feet per second for Unit #22. Terra Nitrogen Port Neal's Title V air quality permit notes a stack volumetric rate of 16,800 feet per minute and a stack diameter of 10

inches. Using the volumetric rate and the diameter, one may convert this information into a velocity in feet per second. Equation 1 identifies the calculation.

Equation 1

$$Velocity = \frac{(Flowrate)}{(Cross\ Sectional\ Area)x(60)}$$

Where the Flow rate = 16,800 feet per minute

$$\text{Cross Section Area} = \left(\frac{(\pi)x(Diamter)^2}{4}\right)$$

Where Diameter = 0.83 feet

$\pi = 3.14$

60 = 60 seconds per minute

The calculated velocity is approximately 517.8 feet per second. The difference in the numbers is likely due to rounding of some of the constants.

For the Siouxland Ethanol, it appears EPA is referring to the 590.8 feet per second for Siouxland Ethanol's emergency water pump. The modeling parameters for the Siouxland Ethanol facility were provided by the state of Nebraska. Nebraska is in a better position to identify stack parameters for facility located in Nebraska than South Dakota. Therefore, South Dakota considers parameters provided by the State of Nebraska as appropriate. However, DENR did obtain information about the fire pump from Nebraska. The fire pump is propelled by a 300 horsepower diesel engine and is limited to 500 hours per year of operation. In DENR's experience the exhaust pipes or stack diameters for fire pumps have been identified as being a nominal 3 inch (0.25 feet) to 4 inches (0.33 feet). This approximately matches the stack diameter provided of 0.3 feet. The velocity is readily impacted by the inside diameter of a small diameter exhaust pipe. The inside diameter is dependent upon the wall thickness of the pipe. As such, the inside diameter of a nominal 3 inch pipe may vary from 2.3 inches to 3.3 inches. Whereas, the inside diameter of a nominal 4 inch pipe may vary from 3.1 inches to 4.3 inches. Depending on the age of the engine, Cummins fire power indicates the volumetric flow rate of 300 horsepower engine will vary from 1,435 to 1,660 cubic feet per minute. Using Equation 1 and varying both the volumetric flow rate and inside diameter, a 3 inch exhaust pipe would have a velocity between 403 and 959 feet per second and a 4 inch exhaust pipe would have a velocity between 237 and 456 feet per second. Therefore, the noted velocity is a valid possibility.

For Hyperion's Power Island Flare, it appears EPA is referring to the 508.8 feet per second. As discussed in some detail as noted in the transcript pages 1355 and 1356 of the Board of Minerals and Environment hearing on Hyperion's permit, the actual velocity of flare is approximately 500 feet per second but at standard conditions is approximately 117 feet per second, which complies with the maximum exit velocity of 122 feet per second as allowed by the federal requirements in 40 CFR § 60.18.

Even though the noted temperatures and velocity were correctly applied, Hyperion arbitrarily revised the following stack parameters in response to EPA's comments and reran the nitrogen

dioxide model based on the "New Value" identified in Table 2 for the Sioux Falls and Sioux City meteorological data sets.

Table 2 – New stack parameters

Model ID	Description	Parameter Changed	November 2010 Value	New Value
IGCCFL2	Power Island Flare	Exit Velocity	509 feet per second	65.6 feet per second
		Diameter	5.0 feet	16.1 feet
NE13	Siouxland Ethanol Fire Water Pump	Exit Velocity	591 feet/second	0.03 feet/second
IA27	Terra Nitrogen Port Neal – EP21	Temperature	1500 Fahrenheit	100 Fahrenheit
IA28	Terra Nitrogen Port Neal – EP22	Exit Velocity	517 feet per second	0.03 feet per second

Table 3 compares the results submitted by Hyperion for the 1-hour nitrogen dioxide modeling using the Sioux Falls and Sioux City data sets for the original scenario submitted to EPA, the scenario with the revised ozone data, and the scenario with both the revised ozone data and arbitrarily revised stack parameters.

Table 3 – Nitrogen Dioxide Model Results Comparison

Scenario	Modeled (ug/m^3)	Monitored (ug/m^3)	Total (ug/m^3)	NAAQS (ug/m^3)	NAAQS Exceedance
Sioux Falls Data Set					
Original	106	45	151	188	No
Revised Ozone	103	45	148	188	No
Revised Ozone and Stack Parameter	103	45	148	188	No
Sioux City Data Set					
Original	88	45	133	188	No
Revised Ozone	88	45	133	188	No
Revised Ozone and Stack Parameter	90	45	135	188	No

As noted by the above table, the revisions to the ozone data and stack parameters for both meteorological data sets also indicate compliance with the National Ambient Air Quality Standards. The revisions proposed by EPA to the ozone data indicate either no change or a slight decrease in the modeled concentrations. The arbitrary revisions to the stack parameters indicate either no change or a slight increase in the modeled concentrations. The noted slight increase was attributable to the change in the stack gas velocity for the Terra Nitrogen Port Neal facility's Unit #22. As noted above, the stack gas velocity used in the modeling does not represent or match the stack gas velocity associated with the design of the facility as listed in the Title V air quality permit issued by the State of Iowa to Terra Nitrogen Port Neal. The changes requested

by EPA did not change the results of the initial modeling completed by Hyperion. A copy of Hyperion's modeling correspondence and modeling files are being provided on the enclosed CD.

Generator operations

EPA notes the modeling analysis assumed only one of the generators would be in operation at any one time and recommends an enforceable condition to implement this restriction needs to be developed.

Same as the comment about testing the nitrogen dioxide to nitrogen oxide ratio, EPA's recommendation involves the type of requirements that may be considered for inclusion in Hyperion's permit. These recommendations should not have a bearing for EPA to concur the PVMRM option in the AERMOD may be used by DENR for the 1-hour nitrogen dioxide National Ambient Air Quality Standard modeling for the Hyperion project. DENR will consider EPA's comment as it reviews Hyperion's request

I would like to restate the South Dakota Department of Environment and Natural Resources is requesting EPA's concurrence that the plume molar volume ratio method based on the information the department provided may be used to demonstrate compliance with the new 1-hour Nitrogen Dioxide National Ambient Air Quality Standard for Hyperion's extension request.

I would like to thank you in advance for your expedited response and concurrence of this request. If you have any questions, please feel free to contact me by phone at 605-773-3151.

Sincerely,

Kyrik Rombough
Natural Resources Engineering Director
Air Quality Program

Enclosure: